

5. WHOOPING CRANE BIOLOGY AND ECOLOGY

Much of the following information is excerpted and revised as needed with permission from the International Whooping Crane Recovery Team report entitled, *International Recovery Plan for the Whooping Crane* (CWS & USFWS, 2006). Other information is gathered from the EMP and FP recovery actions.

5.1 SPECIES DESCRIPTION

The common name "whooping crane" probably originated from the loud, single-note vocalization repeated by alarmed birds. Taxonomically, the whooping crane is in the Family *Gruidae*, Order *Gruiformes*. The closest taxonomic relatives in continental North America are five races of sandhill crane (*G. canadensis*) encompassing the lesser (*G. c. canadensis*), Canadian (*G. c. rowani*), greater (*G. c. tabida*), Florida (*G. c. pratensis*), and Mississippi (*G. c. pulla*) sandhill crane. In flight, whooping cranes can be distinguished from other large white birds with black wingtips (i.e., American white pelican, tundra swan, and lesser snow goose) by their long, extended neck and trailing legs.

The tallest North American bird, whooping crane males stand 1.5 m, 12-20 cm taller than the greater sandhill crane. Males are generally larger than females. The average weight for wild cranes is unknown, although captive males average 7.3 kg and females average 6.4 kg. A crane's weight varies seasonally from a summer-time low to a winter-time high.

The whooping crane's adult plumage is snowy white except for black primaries; grayish or black alulae; sparse, black, bristly feathers on the carmine crown and malar; and a dark gray-black wedge-shaped patch on the neck. The black primaries and alulae can be seen when the wings are extended. In contrast, the short tail is usually hidden by the plumed, decurved tertials. The size of the post-occipital patch varies between individuals. Whooping crane plumage is sexually monomorphic; however, their guard and unison calls are sexually distinct. The bill is dark olive-gray; the base of the bill is pink or rosaceous. During the breeding season the bill becomes lighter. The long, thin legs and feet are gray-black.

Juvenile cranes are a reddish cinnamon color, possibly a protection against predation. When chicks are 80-100 days old, they are capable of sustained flight. By the time they are four months old, white feathers begin to appear on the neck and back. The plumage is predominantly white by the following spring, although rusty juvenile plumage remains on the head, the upper neck, secondary wing coverts, and scapulars. The dark red crown, lores, and malar areas are visible. At one year of age the iris of the eye has changed from blue to yellow. By their second summer, yearlings typically achieve adult plumage.

5.2 MOLT

Information in this plan on the timing, physiology, and behavioral adaptations of cranes to molt is limited to the Florida non-migratory population, but likely can be applied to the migratory Aransas-Wood Buffalo and eastern populations. Although undocumented, the AWBP and the EMP probably experience a simultaneous molt of flight feathers. Biologists collecting eggs or capturing pre-fledged chicks in the AWBP noted the parents

usually flew away during the disturbance. It is likely molt takes place post-offspring fledging, and prior to fall migration.

In Florida, a simultaneous molt of primary and secondary feathers after the breeding season (April – June) leaves whooping cranes flightless for four to six weeks. In Wisconsin, molt is likely to occur from June through August. Most birds undergo molt when they are turning three years of age, although some molt their second year. Every bird recaptured shows evenly worn and yellowed feathers, evidence of a simultaneous molt of flight feathers. The typical bird, after gaining new flight feathers at three years of age, molts again in two to three years. Florida biologists have never witnessed this type of molt two years in a row. All Florida whooping cranes replace their contour plumage every summer or early autumn. The two types of molt are spaced out in time, possibly to reduce stress on the bird.

During molt the cranes typically become secretive and reclusive, taking shelter in marshes and lake edges. This behavior is more commonly seen in pre-fledged chicks or sick or injured adults. Molt behavior is contagious. Non-molting members of a group will assume the secretive nature. When the marshes dry up during drought periods, the bird's flightless status combined with the lack of water makes the birds more vulnerable to predation.

Molt can be difficult to detect directly. A molting bird usually does not flap its wings, perhaps a survival skill to preserve the fragile growing feathers. This makes it difficult to check feather status. Observing a suspect bird flap, stretch, or preen helps. At this time, it is important to look at the more easily-observable primary feathers, since enough wing surface is present without the secondary feathers that they can still fly. Generally, the most visible clue to molt is if a bird has not flown in four to six weeks.

5.3 LIFE SPAN

Whooping cranes are a long-lived species. Current estimates suggest whooping cranes live 24-30 years in the wild and 35-40 years in captivity.

5.4 FOOD HABITS

Whooping cranes are omnivorous, using their long bills to opportunistically forage on available food sources in both wetland and upland habitats. Young chicks are fed by their parents, gradually becoming increasingly independent. They separate from their parents prior to the next breeding season.

Summer foods include large nymphal or larval forms of insects, frogs, rodents, small birds, minnows, and berries. Based on limited research, during migration whooping cranes feed on harvested grain fields, frogs, fish, plant tubers, crayfish, insects, and agricultural grains.

The AWBP winter diet consists mainly of blue crabs (*Callinectes sapidus*), clams, and the plant wolfberry (*Lycium carolinianum*). Most foraging occurs in the brackish bays, marshes, and salt flats lying between the mainland and barrier islands. Occasionally, fresh water and food sources such as acorns, snails, crayfish, and insects attract them to upland sites. Aransas-Wood Buffalo cranes are particularly attracted to upland sites when they are 1) partially flooded by rainfall, 2) burned to reduce plant cover, or 3) when

food is limited in the salt flats and marshes. Roosting continues to occur in the marshes. Some whooping cranes use upland sites frequently; however, agricultural croplands adjacent to the ANWR are rarely visited. The EMP forages more heavily on fresh water sources.

5.5 BREEDING ECOLOGY

Like other long-lived bird species, whooping cranes form long-term, monogamous pair bonds, exhibit delayed (age-related) breeding, produce small clutches, and have a prolonged period of parental care (nine through ten months). Although whooping cranes are monogamous, they will re-pair, sometimes within a few days following the death of a mate. The development of pair bonds can occur during spring migration, on the breeding grounds, or in a subadult population over the course of one through three winters.

Nesting can occur at age three, although the average age of first egg production is five years. In the AWBP, experienced pairs begin nest construction upon arrival at their northern breeding grounds (WBNP). Eggs are laid late April through mid-May and incubated for 29 – 31 days. The light brown or olive-buff eggs are covered with dark, purplish-brown blotches concentrated at the blunt end. Whooping crane eggs average 100 mm in length and 63 mm in width.

Whooping cranes usually produce clutches of two eggs laid 48-60 hours apart. Incubation begins with the first egg laid, resulting in asynchronous hatching of the eggs. In nests with two eggs, the first hatched has the greater chance of survival. Habitat conditions, including food availability and predator abundance, affect survival. In years with suitable habitat conditions crane pairs may raise two young.

Whooping crane parents share incubation and brood-rearing duties. Except for brief intervals, one member of the pair remains on the nest at all times. Females tend to incubate at night and take the primary role in feeding and caring for the young. Chicks are capable of swimming shortly after hatching. During the first three to four days, parents and their young return to the nest at night. Later, parents brood their young wherever and whenever needed, such as at night or during foul weather. During the first 20 days after hatching, families generally remain within 1.8 km of the nest site, with daily movements averaging 340 m.

Whooping cranes usually nest in the same general vicinity each year. These nesting territories, termed "composite nesting areas" range from about 1.3 to 47.1 km², but average 4.1 km². Adjoining pairs usually nest at least 1 km apart; however, nests have been recorded as close as 400 m from each other. Family groups and pairs remain in the breeding territory from egg-laying until the chicks are a few months old.

Whooping cranes may re-nest if their first clutch is destroyed or removed before mid-incubation. However, re-nesting has rarely been observed. Whooping cranes generally nest annually, but may skip a season under poor nesting habitat conditions, if they are nutritionally stressed, or for unknown reasons.

Most juveniles and subadults spend the summer near their natal area. Sexually immature birds (up to four years of age) will pair-up or form small groups of three to five birds on the edges of nesting pair territory.

5.6 MIGRATORY BEHAVIOR

Habitats used by whooping cranes vary annually. During their seasonal cycle, whooping cranes leave their summer breeding areas in the northern U.S. and Canada and migrate to their wintering habitat in the southern U.S.

In whooping cranes migration is a learned behavior. In autumn, juvenile birds learn the migration route by following their parents or older members of the population from their summer breeding grounds to their wintering habitat. On the autumn migration route, cranes use both staging and stopover habitats. Staging habitats are used for variable lengths of time (days or weeks) to gain and store nutrients needed for different stages of their annual cycle. Stopover habitats meet immediate needs for food and energy during migration, requiring a short stay (up to several days) unless weather conditions impede migration.

5.6.1 Spring

As spring approaches, “dancing” behavior (i.e., running, leaping and bowing, unison calling and flying) increases in frequency, indicating pre-migratory restlessness. Family groups and pairs usually depart the wintering grounds first, often assisted by seasonal strong southeast winds. Cranes are diurnal migrants, making regular stops to feed and rest. The AWBP normally begins departure between March 25 and April 15. The last AWBP birds usually leave by May 1, but stragglers may linger into mid-May. Parents separate from their young of the previous year upon departure, while in route, or soon after arriving at the northern breeding grounds. Cranes in the EMP (2002-2006) leave their wintering habitat between February 28 and mid-April.

Spring migration is usually completed in two to four weeks, more rapidly than the reverse trip in the fall, as there is no known spring staging area. Between 1938 and 2002, 33 birds summered at ANWR. Some of these birds were ill, crippled, or mates of crippled birds. At present, no birds in the EMP summer in the southern U.S.

5.6.2 Autumn

Unlike the large gatherings of sandhill cranes that form each fall, whooping cranes migrate south as pairs, in family groups, or as small units of three to five birds. Pairs with young are among the last to leave the breeding range.

The AWBP begins migration in mid-September, with most birds arriving on the wintering grounds between late October and mid-November (Fig. 2). Occasionally, stragglers arrive in late December. The first stop often occurs in northeast Alberta or northwest Saskatchewan, about 500 km southeast of the departure area. Although weather conditions influence distance and direction of travel, on the second day the cranes usually reach the autumn staging grounds in the north-central portion of the Saskatchewan agricultural area. The rest of the migration to the Aransas NWR wintering grounds is usually rapid, probably weather-induced, and may be completed in a week.

Autumn migration for the EMP typically begins later. Departure from Wisconsin ranges from late October to early December, with most birds usually departing mid-November.

5.7 HABITAT USE

Whooping cranes use a wide range of habitats, varying their use during different parts of their annual cycle. The two migratory populations (AWBP and EMP) occupy summer breeding habitats radiating outwards from WBNP in Canada and from central Wisconsin in the U.S. During migration they opportunistically use stopover and staging habitats along the migration flyway. The wintering habitat for these two populations occurs in separate regions of the southern U.S. The non-migratory population uses a variety of upland, wetland, and coastal habitats in Florida.

5.7.1 Historical Migration Habitat

In the 19th century, the two most important migration pathways included the route between Louisiana and the nesting grounds in Illinois, Iowa, Minnesota, North Dakota, and Manitoba, and the route from Texas and the Rio Grande Delta region of Mexico to nesting grounds in North Dakota, the Canadian Provinces, and the Northwest Territories. A route through west Texas into Mexico apparently followed the route still used by sandhill cranes, and it is believed the whooping cranes regularly traveled with them to wintering areas in the central interior highlands region (Allen, 1952). An additional migration route crossed the Appalachians to the Atlantic Coast. These birds apparently nested in the Hudson Bay area of Canada. Coastal areas of New Jersey, South Carolina, and more southerly river deltas were the wintering grounds.

From 1857-1928 specimen records or sighting reports can be found in Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Kentucky, Michigan, Minnesota, Mississippi, Missouri, New Jersey, Ohio, Ontario, South Carolina, and Wisconsin. Gulf Coast locations include Mobile Bay, Alabama, Bay St. Louis in Mississippi, and numerous records from southwestern Louisiana. Coastal Louisiana contained both a non-migratory population and wintering migrants.

In 1911 the last eastern population of whooping cranes (14 birds) was observed in Alachua County in southern Florida. Two whooping cranes were reported east of the Kissimmee River in 1936, and in 1927 or 1928 a whooping crane was shot and photographed in St. Johns County, Florida.

5.7.2 Arkansas-Wood Buffalo Population Migration Habitat

Areas characterized by wetland mosaics appear to provide the most suitable stopover habitat. In the majority of states and provinces, whooping cranes primarily use shallow, seasonally and semi-permanently flooded palustrine (marshy) wetlands for roosting, and cropland and emergent wetlands for feeding.

Spring roosting wetland habitat size has been variably reported as less than 0.5 ha to an average of 36 ha, whereas fall sites average 508 ha. Most roost sites occur within 1 km of a suitable feeding site. Habitat use varies according to family status. Cropland accounts for 70 percent of the feeding sites of non-families, while wetlands account for 67 percent of family feeding sites. Although generally not used, heavily vegetated wetlands are selected by family groups more often than non-families. Large palustrine wetlands used by the AWBP include the Quivira NWR, Kansas; Salt Plains NWR, Oklahoma; Cheyenne Bottoms State Wildlife Area in Kansas; Last Mountain Lake NWA in Saskatchewan; and large reservoir margins in the Dakotas.

Whooping cranes also make use of riverine habitats, especially in Nebraska. Cranes prefer roosting on submerged sandbars in wide unobstructed channels isolated from human disturbance. Frequently used riverine habitats include the South Saskatchewan River, Saskatchewan; the Platte, North, Middle Loup, and Niobrara Rivers in Nebraska; and the Missouri, North Dakota, and Red Rivers in Texas.

Private lands provide critical fall staging habitat in Saskatchewan. Stewardship and conservation activities should target known staging areas and potential breeding wetlands on these private lands. Otherwise habitat could be negatively impacted by drainage, cattle grazing, contaminated runoff, or other disturbances associated with agricultural activities.

5.7.3 Aransas-Wood Buffalo Population Summer (breeding) Habitat

Whooping Cranes formerly bred in isolated marshes on prairies and aspen parkland. The current WBNP nesting area lies between the headwaters of the Nyarling, Sass, Klewi, and Little Buffalo rivers. The area is poorly drained and interspersed with numerous potholes. These wetland areas vary considerably in size, shape, and depth. Most possess soft marl bottoms. Narrow ridges supported by an over story of white spruce (*Picea alauca*), black spruce (*P. mariana*), tamarack (*Larix laricina*), and willows (*Salix spp.*), and an understory of dwarf birch (*Betula glandulosa*), Labrador tea (*Ledum groenlandicum*), bearberry (*Arctostaphylos uva-ursi*), and several species of lichen underlain by sphagnum moss, separate the wetlands. Crane nest sites are primarily located in shallow diatom ponds that contain bulrush (*Scirpus validus*), although cattail (*Typha sp.*), sedge (*Carex aquatilis*), musk-grass (*Chara sp.*), and other aquatic plants are common.

Lightening-induced wildfires usually benefit crane habitat. Wildfires increase habitat accessibility by recycling nutrients and reducing vegetation on the forested ridges between nesting ponds. Although molting adults and flightless young are vulnerable to fire, losses of eggs, chicks, or adults are unconfirmed. Due to the potential negative effects of a major fire control operation in the AWBP nesting area, the area is classified as “moderate response,” limiting fire suppression activities.

At WBNP, whooping cranes face little competition from other bird species for nesting territories. Although sandhill cranes are present, it is unlikely they can out-compete the larger whooping cranes for preferred nest sites. Any territory overlap probably occurs on the dryer sedge nest areas.

5.7.4 Aransas-Wood Buffalo Population Winter Habitat

The AWBP occupies winter habitat on and adjacent to Aransas NWR, encompassing about 9,000 ha of salt flats and adjacent islands. Marshes are dominated by salt grass (*Distichlis spicata*), saltwort (*Batis maritima*), smooth cordgrass (*Spartina alterniflora*), glasswort (*Salicornia sp.*), and sea ox-eye (*Borrchia frutescens*). Inland margins of the flats are dominated by Gulf cordgrass (*Spartina spartinae*). Interior portions of the refuge are gently rolling and sandy. This habitat is characterized by oak brush, grassland, swales, and ponds. Typical plants include live oak (*Quercus virginiana*), redbay (*Persea borbonia*), and bluestem (*Andropogon spp.*).

Studies indicate declining territory size as the population increases, with territories averaging 117 ha. Subadult and unpaired adult whooping cranes form small populations

outside occupied territories. Paired cranes will often locate their first winter territory near one of their parents.

To assist this population in its recovery efforts, over the last 30 years many upland sites have been grazed, mowed, or burned to maintain oak savannah habitat. Plus, human visitation is carefully controlled. Other potentially conflicting uses of the refuge, such as activities associated with oil and gas exploration, are reduced when whooping cranes are present.

5.7.5 Florida Population Habitat

Captive-reared whooping cranes were released in Florida from 1993 through 2004 (Nesbitt et al., 1997). This non-migratory Florida population (FP) soon became sympatric with Florida sandhill cranes (*G. c. pratensis*). The home range size of whooping cranes and sandhill cranes is similar, 447 ha for paired adults. Nesting territories, i.e. areas actively defended against other cranes, average 169 ha (Nesbitt & Williams, 1990).

Florida cranes are equally upland (grassland) and wetland birds. Nevertheless, usable upland foraging habitat may influence reproductive success to a greater extent than wetland availability. Availability of upland habitat is also a factor in determining whether a territory is occupied year round or periodically (Nesbitt & Williams, 1990). Cranes prefer foraging at the edges of open grasslands with low growth vegetative aspects (vegetation less than 0.5 m). Mast crops like dewberries (*Rhus* spp.) and acorns (*Quercus* spp.) are popular food sources. Maintaining suitable upland conditions can be accomplished with the selective use of fire, mowing, and grazing.

Cranes also forage in agricultural fields, particularly harvested corn and peanut fields, livestock feed lots and areas where supplemental grain is provided. Waste grain feeding can be hazardous to cranes. Up to 10 percent of the cranes that feed in these situations acquire the disease, mycotoxicosis, which produces neck paresis. Infected cranes die of dehydration, starvation, or predation.

Cranes prefer roosting in areas of firm, exposed bottom in relatively shallow (less than 60 cm) water surrounded by denser vegetation. Ideally, wetland habitats are maintained as emergent palustrine wetlands dominated by pickerelweed (*Pontederia cordata*) and maidencane (*Panicum hemitomon*). Water quality and quantity is maintained by preventing the area from developing into a cattail or woody plant dominated community.

Marsh feeding sites are critical to a successful early brood rearing phase (days 1-14). A mixture of open shallow water and vegetated areas aids crane movement and feeding. An open herbaceous marsh can be maintained through annual water level fluctuations. Dynamic pulsing of the wetlands can be periodically reinforced (every 2-5 years) with a dramatic event, deep inundation, complete drying, and occasional fire. Timed management events avoid the period of nesting and chick rearing, at least until the young are able fliers (90 days).

5.7.6 Eastern Population Migration Habitat

Most whooping cranes in the eastern migratory population (EMP) demonstrate a direct migration route with opportunistic stops at any wetland available at the end of the flight day (Fig. 3). They usually remain overnight unless poor flying weather requires a longer stay. These sites include natural or managed palustrine, lacustrine, and riverine wetlands as well as farm ponds, reclaimed surface mines, flooded agricultural fields,

catfish production ponds, mountain reservoirs, and river sandbars. Northward migration occurs during late February to mid-April. Autumn migration usually ranges from late October to early December, with most birds migrating during mid-November.

During migration some whooping cranes associate with sandhill cranes. Accordingly, they follow the traditional eastern greater sandhill crane migration flyway, stopping at the expansive wetlands at Jasper-Pulaski State Fish and Wildlife Area in Indiana and at Hiwassee State Wildlife Refuge in Tennessee.

Migration roost habitat ranges from extensive, permanent wetlands to relatively small stock ponds. Sites used generally satisfy safe, short-term habitat requirements (i.e., in water more than 20 feet from shore). In general, whooping cranes improve roost site selection in their first unassisted fall migration over that in their first spring migration. During migration, whooping cranes often feed in grain fields, especially harvested cornfields near the roost site. Due to the broad range of potentially usable sites and the need to use them for only a few days, adequate stopover habitat does not appear limiting even in mountainous parts of the migration route.

However, whooping cranes in fall 2004 often remained at the same stopover sites for extended periods, even when weather conditions were suitable for migration. This behavior raises concerns regarding the risk of an unintentional whooping crane shooting at a stopover site during open waterfowl seasons, especially in areas west of the mainstream sandhill crane route where snow geese are hunted.

5.7.7 Eastern Migratory Population Summer (breeding) Habitat

From spring through early summer, whooping cranes use a diversity of wetland habitats throughout Wisconsin, Minnesota, northeastern Iowa, Illinois, and Michigan. Sometimes they relocate daily. In the first four years of the release program (2001-2005), whooping cranes were observed in 35 of 72 Wisconsin counties, primarily within the lower two-thirds of the state along major rivers and wetlands, including the lower Wisconsin and Mississippi Rivers. Lacustrine marshes, such as those associated with Puckaway, Rush, Yellowstone, and Poygan Lakes are also used. So far, EMP crane habitat use includes any wetland with minimal human disturbance, even small isolated wetlands (Appendix 6). For example, several 2003-released birds spent significant portions of spring and summer along sloughs and oxbow lakes associated with the Little Yellow River south of Necedah NWR. Small numbers of birds used the marshes of the Briggsville area during both summer and autumn, particularly those associated with Neenah and O'Keefe Creeks.

5.7.7.1 Necedah National Wildlife Refuge

Whooping cranes at Necedah NWR appear to shift their daytime movement patterns within the mosaic habitats at the refuge to take advantage of the shifting abundance in food resources. Some older birds established territories around the three ultralight training sites, preventing significant use by 2003 and 2004 released birds.

Birds summering at Necedah typically use the shallow waters and emergent wetland vegetation bordering the managed impoundments. Small numbers of birds use the natural sedge meadows. In addition to the emergent vegetation zones, the birds use palustrine and upland scrub-shrub areas associated with the marshes for daytime foraging and loafing activities.

Use of oak savannah habitat occurs primarily during late spring and early summer. Crane use often follows prescribed burns which open the understory and expose invertebrates. In early and midsummer, birds are often seen foraging on blueberries and sarsaparilla in the upland scrub areas, most notably the Bee Cut area.

At the refuge, pool draw-downs create ephemeral foraging habitat by trapping fish and other aquatic prey. The cranes also probe for food in the newly-exposed mudflats. This phenomenon naturally occurs during drought conditions.

5.7.7.2 Meadow Valley State Wildlife Area

Foraging, roosting and nesting all occur at Meadow Valley. In 2005 and 2006, two pairs started nesting at two different locations. Both attempts failed for unknown reasons. Future nesting attempts are anticipated.

5.7.7.3 Cranberry Beds and Reservoirs

Cranberry farms in the reintroduction area have provided foraging and roosting habitat for many whooping cranes, particularly during the spring and autumn months.

5.7.7.4 Mill Bluff State Park

The unmanaged impoundment marshes and surrounding agricultural areas of Mill Bluff State Park provide summer habitat for small numbers of cranes, and spring and autumn habitat for larger groups of birds. Continued use of these marshes may eventually lead to a shift toward territories being claimed by breeding birds.

5.7.7.5 Horicon National Wildlife Refuge

Summer foraging and habitat needs have been provided from 2002 until present for at least one whooping crane at Horicon NWR and adjacent private lands. Thousands of visitors have either learned of the project or seen the 'Horicon whooper' (bird #7-01) in this region of the state.

5.7.7.6 Food Preferences

In the spring, birds generally forage in the previous year's cornfields and then briefly in the newly planted fields. A few observations noted birds foraging in cornfields over 3-feet high. This behavior may occur more frequently when bare patches or height variations exist in the field. In autumn, many birds begin to leave their summer territories and utilize this rich food source shortly after harvest.

Like sandhill cranes, in spring and autumn whooping cranes feed in grain fields near their roost sites. Harvested cornfields are preferred. In contrast to sandhills, whooping cranes prefer foraging in wetlands, especially in summer. Sandhills roost in wetlands but frequently fly to uplands or croplands for daytime foraging, while whooping cranes often remain in wetlands for most or all of the day. Unlike sandhill cranes, whooping cranes primarily forage in the morning and evening and frequently loaf during the day.

Both whooping and sandhill cranes feed on grain, tubers, rhizomes, blueberries, and terrestrial insects, especially grasshoppers. However, whooping cranes appear to have a broader diet including fish, frogs, and aquatic invertebrates. Both crane species prefer mudflats or shallows on drawn down pools. Whooping cranes, however, made more efficient use of these areas by feeding heavily on animals trapped in the receding water. Bullheads were a major component of the whooping crane's diet, especially on draw-

downs on Rice and West Ryneerson Pools, and Upper Rice Pool (Necedah 2003). Crayfish were a preferred food item where they occurred (e.g., the prairie sloughs of South Dakota, 2003). At Necedah NWR, a 2004 large blueberry crop on the Bee Cut provided a major mid-summer food source, which encouraged formation of a subadult group of up to eight birds at this site.

5.7.7.7 Nesting

Two 2005 nesting attempts at Necedah NWR by two young pairs were unsuccessful in part due to egg predation. At least one pair of young birds was inattentive and left the nest rather than incubate. In 2006, five nests were incubated by five pairs of whooping cranes for up to two weeks. They failed for unknown reasons. Four nests initially occurred at Necedah NWR; one nest was on the Meadow Valley SWA in the Monroe County Flowage. One pair of fertile eggs was rescued from an abandoned Necedah nest, incubated at ICF, transferred to Patuxent Wildlife Research Center for hatching, where one chick became part of the 2006 ultralight-led release cohort. On 23 May, a pair re-nested at Necedah and ultimately by 22 June produced the first two wild-hatched chicks of this project.

Figuring out why nests are being abandoned is a priority for WCEP. The situation of most nests abandoned is beyond the realm of expectation, and plans are underway to set up film cameras at future nest sites to find out why this occurred. This investigation is important enough to take some risks that might cause nest abandonment.

Multiple people in Wisconsin have seen whooping crane pairs on nests and even taken photographs, meaning the pairs are not abandoning nests the first time they see a human. Risks can be minimized by filming a subset of nests and not filming every nest. Camera distance from the nest may depend on available cover, vegetation type, behavior of the pair, and be suit site specific needs.

Future nesting is expected to occur in the primary central Wisconsin release location at Necedah NWR, Meadow Valley State Wildlife Area, and surrounding wetlands of Monroe, Jackson, Wood, Marathon, Adams, and Marquette counties. As whooping cranes spread throughout the state, it is reasonable to assume that nesting may occur in similar suitable habitat along the lower Wisconsin and Mississippi Rivers and near Horicon Federal and State Wildlife Refuges.

5.7.8 Eastern Migratory Population Winter Habitat

The Chassahowitzka NWR salt marsh and surrounding central Gulf Coast area was originally selected as the reintroduced population's wintering grounds, a site closely resembling the AWBP winter habitat at Aransas NWR. Both refuges share a coastal location and an abundance of blue crabs as a key food source. However, although Chassahowitzka NWR serves as a high-quality release area, for each year's new cohort of ultralight-led birds, tidal and other habitat conditions hinder establishment of winter territories by returning birds. During the project's first four years, wintering migratory whooping cranes chose inland freshwater habitat over the originally saltwater coastal wintering area. Some birds visit the salt marsh pen site upon return from fall migration, but then move inland to freshwater habitat for the remainder of winter. Other birds have chosen to winter in Tennessee, South Carolina, and North Carolina wetlands.

5.7.8.1 Coastal Salt Marsh Habitat

Approximately one half of Florida's ~170,000 ha of salt marsh habitat are located within the Big Bend region, which stretches along the Gulf Coast from Aripeka to Apalachicola

Bay. Chassahowitzka NWR lies within this region. This area is characterized by a tidal range higher than that of the western panhandle and by low levels of relief and wave energy. The salt marsh is irregularly flooded by lunar and wind blown tides and a seasonal rise in sea level. About 60 percent of northwest Florida's salt marsh is dominated by dense monospecific stands of black needlerush (*Juncus roemerianus*), with a narrow band of smooth cordgrass (*Spartina alterniflora*) often occurring at the edge of the tidal creeks (Montague & Weigert, 1990). The release pen at the Chassahowitzka site encompasses a tidal pool area and a small amount of surrounding upland. Here the needle rush has been burned and flattened to increase suitability for whooping cranes. Patches of less dense salt grass (*Distichlis spicata*) provide natural loafing areas for the birds. A pre-existing oyster bar was augmented to create a smooth, sloping surface to accommodate the cranes' roosting requirements at varying water depths. These alterations to the immediate pen area, along with the supply of fresh drinking water, have created an oasis of suitable crane habitat surrounded by vast areas that have proven undesirable.

Although the high productivity and density of plant stems in the salt marsh provide ample food and cover for birds, the intense fluctuations in salinity and water level result in a physiologically stressful environment. Few animals are adapted to withstand these kinds of fluctuations over time (Montague & Weigert, 1990). Many salt marsh visitors avoid these environmental extremes by leaving when conditions become unbearable. This temporary utilization of salt marsh habitat in Florida as well as Georgia, North Carolina, and South Carolina, has been the dominant pattern in older whooping cranes of this population.

5.7.8.2 Florida Inland Habitat

Whooping cranes have been fairly consistent in their winter habitat selection. Some birds first try out and then abandon salt marshes while others seek out inland areas containing freshwater marshes, including large highland marshes such as Paynes Prairie, Clermont Marsh, and Hawthorne Prairie. More often, the birds utilize smaller highland or flatwood marshes adjacent to dry prairies used for cattle grazing. Many of the birds forage in these upland pastures during the day, particularly utilizing pastures with a nearby water source such as a ditch or small pond.

During the winter of 2004-2005, one pair of whooping cranes foraged on dairy cattle pastures and roosted on an impoundment at Lake Woodruff NWR, part of the formerly extensive St. John's River Marshes complex. Marshes used by whooping cranes may contain plant assemblages characteristic of flag marshes, wet prairies, saw grass marshes, or cattail marsh. Most important appears to be the existence of shallow water suitable for roosting. During the winters of 2003, 2004, and 2005, small numbers of whooping cranes spent all or a significant portion of the season at Hixtown Swamp, a complex of cypress swamps, marshes and ponds in central, north Florida. Agricultural crops such as rye and peanut fields also provide foraging habitat.

5.7.8.3 Habitat in States Other than Florida

During the 2005 to 2006 winter, 10 of 64 birds wintered outside Florida; seven birds wintered in Tennessee, one in South Carolina, and one in North Carolina. One bird was last seen in Alabama prior to its spring migration to Wisconsin. During the previous year, 14 birds from the project wintered in Tennessee, North and South Carolina (Fig. 5). It is reasonable to anticipate ever larger numbers of whooping cranes wintering outside Florida as this restoration effort continues.

In Tennessee, birds remain at or near Hiwassee State Wildlife Refuge (Meigs County), where they roost along river sandbars and forage in harvested cornfields. Birds have also wintered in Franklin County.

In South Carolina, one male crane spent the winter on Bull Island, a private coastal island just west of Hilton Head. Managed primarily for dove hunting, the grain and cornfields planted for dove habitat provided food for the crane, while the man-made ponds supplied freshwater. This crane typically roosted in a brackish impoundment marsh on the island's edge. The remaining South Carolina birds utilized areas within or near the Ace Basin project, which consists of private, state, and federal lands managed for wildlife and human benefits. Much of the area consists of former rice plantations (converted from inter-tidal marshes) that now contain, among other habitat types, flooded cornfields, brackish marshes, or freshwater marshes. Before settling into their final inland freshwater wintering areas, some of these birds temporarily utilized coastal salt marshes dominated by smooth cordgrass (*Spartina alterniflora*), or islands along the Atlantic Coast of Georgia, including some islands of the Savannah NWR complex

In North Carolina, birds roost and forage in a small flooded clear-cut in a river bottom. Foraging also occurred in an adjacent harvested cornfield, and occasionally in nearby upland farm fields.

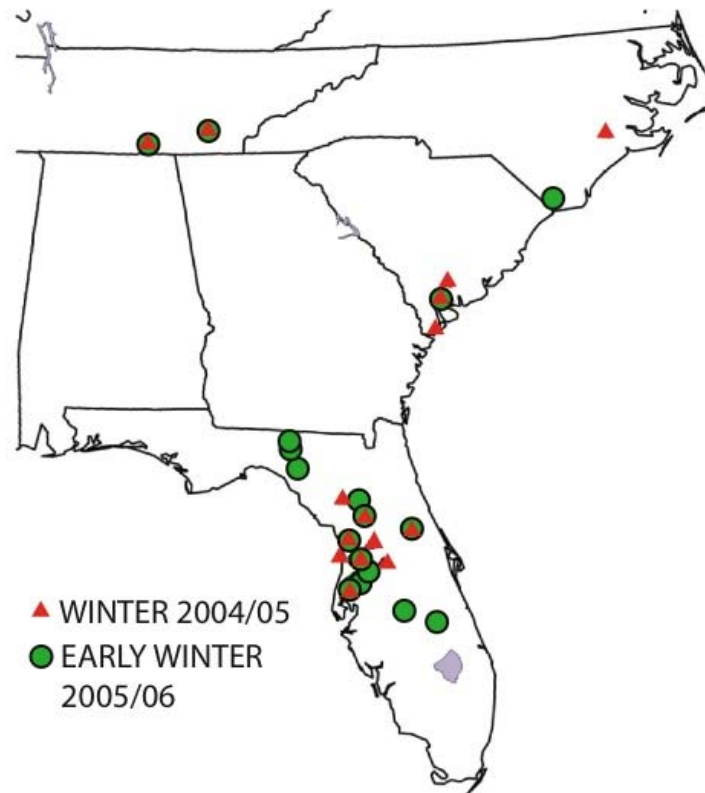


Figure 5. Wintering EMP habitat use, 2004-2006.

5.8 POPULATION DYNAMICS IN THE ARANSAS-WOOD BUFFALO POPULATION

While whooping crane numbers are increasing, the actual rate of increase is declining. Whooping crane life-history is characterized by a long life span, delayed sexual maturity, permanent pair bonding, small clutch size (one – two eggs), and a long period of bi-parental care. The current northern breeding grounds may be a limiting factor to productivity because of the limited four-month ice free season. During that time, pairs must incubate their eggs for 29-31 days and rear their chicks to flight age in 3 months. Consequently, unless nest loss occurs early in incubation, there is rarely time to lay a second clutch and fledge young if the first clutch fails.

The AWBP is increasing at an exponential rate ($R^2=0.973$) averaging 4.5 percent per year over a 65-year period. The current population is over nine times the population level 60 years ago. The whooping crane has a long-term recruitment rate of 13.9 percent, the highest of any North American crane population (Drewien, Brown, & Kendall, 1995). However, there is a suggestion of a decline ($R^2=0.206$) in crane recruitment. Recruitment averaged 0.204 young per adult before the 1938-1966 egg removal program (one egg was removed from a modest number of nests for hatching elsewhere), 0.133 young per adult during the egg removal program (1967-1992), and 0.120 young per adult in recent years (1993-2004). There is also evidence of a ten-year cycle in recruitment emerging in recent decades as the variance of annual estimates has decreased.

The growth of the AWBP appears to result from increased survival. The disappearance rate of cranes between years averaged 9.8 percent. However, annual mortality of the AWBP declined from 12.1 percent before 1970 to 7.6 percent from 1970-2000. Between 2001 and 2005, annual bird mortality averaged 6.7 percent.

If the exponential growth rate continues, population viability assessments suggest the AWBP will reach 500 cranes around 2040 and 1,000 cranes by 2080 (from updated regression data, Mirande et al., 1991; Mirande et al., 1997; Brook, Cannon, Lacy, Mirande, & Frankham, 1999). No evidence of density-dependence exists; however, this needs to be reevaluated as the population grows beyond the scale of past data. While the large variation in annual growth rate makes predictions difficult, it is likely the AWBP will continue growing over the next 100 years, with a very low probability of extinction (Mirande et al., 1997).